second part of the examination there will be two questions at least in each branch of science included in the examination in each paper.

THERE are now about ten courses of professional and inter-collegiate lectures announced at Cambridge for the benefit of the selected Indian Civil Service Candidates; so that Oxford, Cambridge, and London are fairly in the field of competition in educating men for this great field of labour.

WE notice with pleasure that the Cambridge Senate have conferred the honorary degree of Master of Arts on Mr. Pattison Muir, prælector in chemistry at Caius College.

MR. J. G. FITCH's lectures at Cambridge this term, on the practice of education, are attended by between sixty and seventy students, of whom about one-half are men. The new literary schools are soon in use. There will be an examination for teachers in June, under the Teachers' Training Syndicate, and certificates will be granted for theoretical knowledge in teaching. Mr. Oscar Browning will keep a register of all the university men who pass the examination, and will act as a means of communication between them and head-masters who require assistants. With all the more confidence we may look forward to great advantages from Mr. James Ward's lectures on the Theory of Education next term, he having given high proof of ability as a physiologist.

THE Cambridge Natural Science Board announces that Prof. Hughes's lectures this term are on the Pre-Cambrian and Carboniferous rocks, while in palæontology, Mr. Tawney will lecture on Trilobites. Mr. Walter Keeping, B.A., continues his (open) lectures at Christ's College, on Rocks and Rock Masses, their Formation and Metamorphosis.

MR. HILLHOUSE is lecturing on botany in the lectures for women, and Mr. Walter Keeping on geology supplementing Prof. Hughes's lectures.

A NEW Cambridge medical association has been formed, and has obtained permission to meet in the old anatomical schools. Every effort will be made to render this association a most valuable means of advancing the interests of medical science in the University.

PROF. STUART and Mr. Garnett are the examiners in mechanism and applied science for the year.

THE law on the constitution of the high council of education in France is progressing favourably before the Senate. No other members will be admitted than professional teachers, except delegates of the five National Academies: Sciences, Beaux Arts, Française, Sciences Morales et Politiques, Inscriptions et Belles Lettres.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 29.—"A Note on Protagon." By Arthur Gamgee, M.D., F.R.S., Brackenbury Professor of Physiology in Owens College, Manchester.

In this paper the author notices the allegations of Thudichum that protagon is an impure body containing more than 1 per cent. of inorganic matters, including no less than 0·76 per cent. of potassium.

He communicates a report from Prof. Roscoe, F.R.S., whom he requested specially to determine the mineral impurities and the amount of potassium in one of the samples of protagon, of which the analyses had formerly been communicated to the Royal Society.

By means of the spectroscope Dr. Roscoe determined the existence of a trace of potassium, which he estimated as equal to one-twentieth of a milligramme in one gramme of protagon (0·005 per cent.). Further, he found that on ignition protagon left a small quantity of fused metaphosphoric acid corresponding to 1·08 per cent. of phosphorus; the mean quantity of phosphorus deduced from the observations of Gamgee and Blankenhorn being 1·068.

"On the Physical Constants of Liquid Hydrochloric Acid." By Gerrard Ansdell, F C.S., Chemical Assistant at the Royal Institution. Communicated by Prof. Dewar, F.R.S.

In continuation of my former experiments on the properties of liquid acetylene gas, I have recently examined the physical constants of liquid hydrochloric acid. The gas was made by the action of strong sulphuric acid on dry chloride of ammonium, being afterwards freed from sulphuric acid and dried before entering the tubes.

The Cailletet pump was used in the same way as described in my former paper, two iron reservoirs being used, one containing the air manometer, and the other the tube with the gas to be liquefied.

Apart from the mere determination of the vapour tensions, densities, &c., the ratios of the volume of saturated vapour to that of the liquid was considered of the highest importance, as from these numbers the latent heat of transformation and other important data can be easily calculated. For these reasons the gas was examined in rather a different way to the acetylene, the volume to which it had been compressed at the point of liquefaction (or the volume of the saturated vapour) at any given temperature being first accurately determined, and then the pressure increased until the condensed liquid entirely filled the upper part of the tube. The volume of this liquid column was then measured, so that a comparison between the volume of the saturated vapour and the volume of the total condensed liquid was obtained at each temperature.

The results of the whole series of experiments are recorded in a condensed form in the following table:—

A.	B.	C.	D.	E.	F.
4	137·31	$\frac{1}{38{\cdot}89}$	7·55	18·18	29·8
13·8	103·50	$\frac{1}{53{\cdot}19}$	8·35	12·39	37·75
22·0	81·19	$\frac{1}{70{\cdot}06}$	9·10	8·92	45·75
33·4	55·75	$\frac{1}{105{\cdot}98}$	10·12	5·50	58·85
44·8	36·34	$\frac{1}{168{\cdot}67}$	11·96	3·03	75·20
48·0	31·33	$\frac{1}{197{\cdot}60}$	12·00	2·61	80·80
50·56	25·70	—	14·30	1·79	85·33
51·00	23·96				

In this table

A = temperature of gas.

B = volume of the saturated vapour at point of liquefaction.

C = fractional volume of the gas at point of liquefaction in relation to the initial volume under one atmosphere of pressure.

D = volume of the condensed liquid.

E = ratio of volume of liquid to that of the gas.

F = pressure in atmosphere.

The critical point was found to be 51°·25 C.

It will be seen from this table that the volumes of the saturated vapours and liquid gradually approach each other as the temperature nears the critical point, and would undoubtedly become identical, if the experiments could be carried on up to the critical point.

The ratio between the volume of the saturated vapour and the volume of the liquid at different temperatures decreases very regularly until within about three degrees of the critical point, where a singular point in the curve occurs, and the ratio approaches unity with great rapidity. The volume of the liquid increases very regularly up to a temperature of about 48° C., and at 51° C., or within 0·25 of a degree of the critical point, the distinction between the saturated vapour and the liquid vanishes, as although liquid is plainly seen to condense on the surface of the mercury, on increasing the pressure the line of demarcation immediately disappears, and it is impossible to say whether the tube is filled with the saturated vapour or the liquid itself; herefore no results could be obtained nearer the critical point than about a fourth of a degree.

Avenarius, in a paper entitled "The Causes which determine the Critical Point" ("Acad. Sci. St. Pétersbourg," 1876-77), made a number of experiment on ether, and came to the conclusion that the volumes of the saturated vapour and of the condensed liquid at the critical point were not identical.

My own experiments appear to confirm his results, in so far as it is evidently impossible to measure the relative volume of fluid and gas within less than a fourth of a degree of the critical point, and at this place the volumes are certainly unequal. This, however, does not disprove their identity as the critical point.

The density of the liquid at different temperatures was determined in the same way as described in my former paper, and gave the following numbers:—

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Temperature.	Density.
0° C.	·908
15·85	·835
33·0	·748
47·8	·619

It has therefore not quite such a high density as liquid carbonic acid which is 0·95 at 0° C., and is about twice as high as acetylene, which is 0·450 at the same temperature. It is interesting to note that acetylene is the lightest known fluid substance. Unfortunately Faraday does not seem to have determined its density.

Mathematical Society, February 12.—C. W. Merrifield, F.R.S., president, in the chair.—Mr. D. Edwardes was elected a Member, and subsequently admitted into the Society.—The following communications were made:—Geometrical notes, by Prof. H. J. S. Smith, F.R.S.—On the reflection of vibrations at the confines of two media between which the transition is gradual; and on the stability or instability of certain fluid motions, by Lord Rayleigh, F.R.S.—The calculus of equivalent statements further communication), by Mr. H. McColl.

Geological Society, February 4.—Henry Clifton Sorby, F.R.S., president, in the chair.—Francis Bond, Charles Herbert Cobbold, Frank Crisp, William Henry Dover, Mirza Mehdy Khan, John Notman, and John Evelyn Williams, were elected Fellows of the Society.—The President announced that, according to a circular, copies of which had been sent to the Society, certain old students of Freiberg were endeavouring to collect the means for erecting a monument in Freiberg to the memory of the late Prof. Bernhard von Cotta, and, further, of establishing a fund for the assistance of needy students at the Mining Academy of that place.—The following communications were read:—On the oligocene strata of the Hampshire Basin, by Prof. John W. Judd, F.R.S. The study of the succession of strata in the fluvio-marine series of the Isle of Wight and the New Forest is attended with considerable difficulties, partly on account of the inconstant character of the beds composing estuarine formations, and partly because of the thick superficial deposits which everywhere cover them. By Webster a lower freshwater series, a middle marine, and an upper freshwater series were recognised; but Mr. Prestwich showed, in the year 1846, that at Hamstead Cliff we have both freshwater and marine strata lying above all these; and in 1853 Edward Forbes proved that the marine and freshwater strata seen at Bembridge Ledge were not, as had previously been supposed, the equivalent of those of Headon Hill, but occupy a distinct and higher horizon. Hitherto, however (in spite of some suggestions to the contrary which were made by Dr. Wright and Prof. Hébert), the strata exposed at the base of Headon Hill have been believed to be a repetition, through an anticlinal fold, of those seen at Colwell and Totland Bays. In the memoir it is shown, both by stratigraphical and palæontological evidence, that the Colwell and Totland Bay beds are distinct from and overlie those at the base of Headon Hill. The distinctness and importance of the purely marine series exposed at Whitecliff Bay, Colwell Bay, and several localities in the New Forest is pointed out; and it is shown that, among the 200 forms of mollusca which they contain, only one-fifth are found in the Barton clay below. For this important division of the strata the name of the *Brockenhurst Series* is proposed. In consequence of the detection of an error in the accepted order of succession of the strata, a rectification of the classification of the fluvio-marine series is rendered necessary, and it is proposed to divide them as follows:—1. The Hempstead Series (marine and estuarine), 100 feet. 2. The Bembridge Group (estuarine), 300 feet. 3. The Brockenhurst Series (marine), 25 to 100 feet. 4. The Headon Group (estuarine), 400 feet. By this new grouping the strata of the Hampshire Basin are brought into exact correlation with those of France, Belgium, North Germany, and Switzerland; and the whole series of fluvio-marine beds in the Isle of Wight, which are shown to have a thickness of between 800 and 900 feet, are proved to be the representatives of the lower and middle oligocene of those countries. The use of the term oligocene in this country is advocated on the ground that by its adoption only can we avoid the inconvenient course of dividing the fluvio-marine series between the eocene and the miocene.

PARIS

Academy of Sciences, February 9.—M. Edm. Becquerel in the chair.—The death of General Morin was announced. (M. Tresca's funeral discourse appears in *Comptes Rendus*.)—On virulent maladies, and particularly on the malady commonly called the cholera of fowls, by M. Pasteur. The small organism (or *microbe*) which causes this malady can be well cultivated in bouillon of fowl's muscles neutralised by potash, and sterilised by a temperature of 110° to 115°. Inoculation of guinea pigs with it causes only abscess, but fowls inoculated with contents of the abscess die. Fowls or rabbits living in company with the guinea-pigs having abscess become ill and die. The microbe multiplies in the intestines of fowls that have taken it with food, and the infected excrement is fatal to fowls inoculated with it. Repeated culture of the microbe by transference of minute drops from liquid to liquid, does not weaken the virulence, but by a certain mode of culture M. Pasteur *can* weaken it. If twenty out of forty fowls be inoculated with the very virulent virus, they nearly all die; but if the other twenty be inoculated with the attenuated virus, they all become ill, but very few die; inoculation of those that recover with the very infectious virus does not kill them. The novelty here is the preservative effect of inoculation in a disease caused by a living organism (in the virus of small-pox, &c., no life has been proved). The cholera of fowls may be prevented from becoming fatal, and the author describes the return to health of a fowl inoculated in the large pectoral muscles. He expresses the hope of obtaining artificial cultures of all kinds of virus, and notes the encouragement obtained for the search of vaccine virus of virulent maladies.—Epidemic caused in *Diptera* of the genus Syrphus by an *Entomophthora* fungus, by MM. Brongniart and Cornu. The Secretary, referring to this vast destruction of insects, recalled M. Pasteur's suggestion to seek the destruction of phylloxera by inoculation with some microscopic fungus, and invited the attention of naturalists to the subject.—Spectrometric measurement of high temperatures, by M. Crova. He describes an apparatus called a *spectro-pyrometer*. The optic zero corresponds to about 580° C., 1,000 optic degrees, to 1,900° C. Temperatures can be measured up to nearly 2,000° C.—Statistics of solar spots of the year 1879, by M. Wolf. The Zurich observations, completed by similar series at Palermo, Rome, Athens, Madrid, &c., gave, for mean relative number for 1879, $r = 6·0$ in place of 3·4 for 1878. Thus the epoch of minimum is distinctly passed. The series of observations of magnetic declination at Milan, Vienna, Prague, Munich, and Christiania, agree in giving 1878·5 as the epoch of minimum. Comparing with the preceding epochs of minimum and maximum, the two periods (spots and magnetic variations) are found in remarkable harmony, both as to total length, 11·7 years, and as to the two parts of the period (which is slightly longer than the average of 11¼ years).

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